Component Breakdown of Sealless High Pressure Pump Skids

By: Chris Pasquali, CEO Factory Direct Pipeline Products, Inc.

#

In this article we outline the steps required to properly size and configure a complete pump skid. You will learn the information required and the various components incorporated into our standard pump skid design.

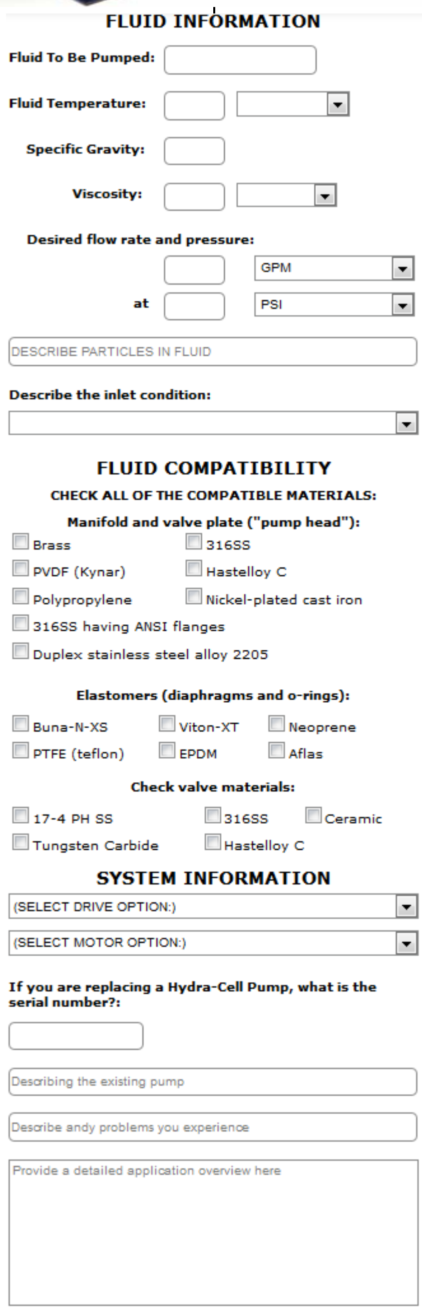
The first thing we must establish is which model pump we are to provide for a given application and this can become a complex task which goes far beyond the desired flow rate and pressure. Water and other relatively non-aggressive (abrasive or chemically) fluids can be relatively straightforward applications. Pumping slurries, fluids at extreme temperatures and providing a specific range of flows are just a few examples that can influence the size of the pump required.

This article will focus on our Hydra-Cell sealless positive displacement pumps however the design of these pump skids and the process of sizing pumps are similar for other types of pumps.

The easiest way for us to gather the required data is to use our Internet based inquiry form, as it prompts for all the information we need and you simply leave the non-applicable sections blank. Our inquiry form will enable us to not only size your pump but also configure its materials of construction to maximize performance.

The pump size is a reference to its capacity and that is typically expressed in gallons per minute (GPM) or gallons per hour (GPH). We need to know the maximum flow rate required to ensure the pump is physically large enough to displace that flowrate.

If your fluid is significantly abrasive, hot, viscous or shear sensitive we might "oversize" the pump. This means we would suggest a pump having a capacity perhaps as much as double your flow rate requirement such that the pump would operate at a significantly lower shaft speed.



FLUID INFORMATION

Fluid To Be Pumped:

Fluid Temperature:

Specific Gravity:

Viscosity:

Desired flow rate and pressure:

GPM

at PSI

DESCRIBE PARTICLES IN FLUID

Describe the inlet condition:

FLUID COMPATIBILITY

CHECK ALL OF THE COMPATIBLE MATERIALS:

Manifold and valve plate ("pump head"):

- Brass
- 316SS
- PVDF (Kynar)
- Hastelloy C
- Polypropylene
- Nickel-plated cast iron
- 316SS having ANSI flanges
- Duplex stainless steel alloy 2205

Elastomers (diaphragms and o-rings):

- Buna-N-XS
- Viton-XT
- Neoprene
- PTFE (teflon)
- EPDM
- Aflas

Check valve materials:

- 17-4 PH SS
- 316SS
- Ceramic
- Tungsten Carbide
- Hastelloy C

SYSTEM INFORMATION

(SELECT DRIVE OPTION:)

(SELECT MOTOR OPTION:)

If you are replacing a Hydra-Cell Pump, what is the serial number?:

Describing the existing pump

Describe andy problems you experience

Provide a detailed application overview here

Shaft speed and Positive Displacement Pumps

Hydra-Cell pumps, like all other positive displacement pumps, displace a fixed volume of fluid per pump shaft rotation with the discharge pressure having negligible effect on the volume displaced. The flow direction through the pump is controlled by internal check valves and thus the flow rate has a corresponding velocity across these valves; most importantly between the valve and its' seat. Higher flow rates equate to higher velocities through the check valves and therefore an application involving a significant amount of abrasive material suspended within the fluid benefits from lower velocities as it slows the abrasive wear of the check valve components. Materials such as tungsten carbide and ceramic are sometimes used for the valves to extend their wear life.

It is a similar rationale when considering the fluids viscosity and temperature, often operating the pump "slower" is beneficial.

The required discharge pressure is another significant factor to consider; the Hydra-Cell pump product family includes pumps for pressures from about 30 PSI to as high as 5000 PSI. (There are fewer options for pressures over 1000 PSI.) The pressure required, in conjunction with the maximum flow rate requirement, determines the motor horsepower required. While some applications benefit from engine, air and hydraulic motors, for us those are atypical applications, so this article focuses on electric motors.

Each pump model has a formula associated with it to determine the horsepower required (HPr). When a flow range is required, it is important to ensure that the motor selected will provide sufficient shaft torque at the low-end of the flow range. We have created a spreadsheet that provides the motor requirements based upon input of a pump model, minimum flow rate and maximum pressure. The last aspect of the motor selection is determining if special features, such as "explosion-proof/hazardous duty"

#

is required; for low HP motors you might have a choice of single or three phase motors.

The pump model will determine the motor pump (NEMA) frame required and the importance of this is how we ultimately connect the pump and motor shaft together.

The actual coupling of pump-to-motor is typically through the use of a "shaft coupling". A three-piece design consisting of two geared stainless steel pieces attached to the two shafts and a sleeve, which synchronizes the two shafts together. There are some exceptions; we offer a few pump models having "hollow shafts" which can accept insertion of the motor shaft directly into the pump, eliminating the need for a coupler and coupling guard. Some customers use belts and pulleys to convey motor shaft rotation to the pump shaft, controlling the pump shaft speed by the pulley diameter ratios.

Pump and motor shaft alignment are important, without proper and stable alignment the coupling will fail and shaft deflection could damage the pump or motor shaft seals. This applies to belt-driven systems also to maximize belt wear life. Proper pump/motor alignment is achieved with an adapter or multi-level pump base, depending upon the pump size and whether it is direct driven or belt driven.

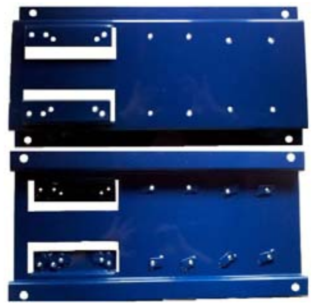
Hydra-Cell pumps for flow rates up to 20 GPM can be attached to the motor to ensure proper shaft alignment. These "pump-motor-adapters" are an epoxy coated cast aluminum spool with one end machined to align with cap screws on the shaft side of the pump and the other end matches-up with the NEMA cap screw pattern. Therefore the motor size, specifically its NEMA frame, dictates half of the coupling size, the adapter model and size of the pump/motor baseplate.

If we do not have an adapter for the pump model or motor size, proper alignment is achieved based upon the design of the baseplate. Our baseplate models are designed for specific pump and motor sizes, having pre-drilled mounting holes with threaded nuts welded onto its underside to enable all fastening to be done from the topside.

If there is a difference in the mounting feet to shaft centerlines of the pump and motor, the baseplate will have a built-in raised pad for the pump or motor such that the shafts will align correctly; the pads ensure proper vertical and horizontal alignment.

As illustrated on the first page, if you mount a pump to a motor with an adapter there is no need to support the pump – it "hangs" off the adapter. It is acceptable if the motor hangs off the adapter, which might be applicable in some oversized pump applications requiring relatively low pressures.

It is certainly possible to forgo using a baseplate with adapter coupled designs and simply attach the motor or pump to whatever substrate you desire. The Wanner Engineering baseplate design enables adapter-coupled systems to lay on the floor and they have holes for firmly mounting to a substrate such as a pump pad.



Systems which are "flex coupled", meaning without using a pump-motor-adapter, benefit from the Wanner Engineering baseplate design as they've already figured-out the appropriate elevation for the pump/motor. The baseplates for these systems come with a coupling guard to prevent accidental contact with the pump and motor shafts.

Belt driven systems have a slightly more complex baseplate design because the motor or pump needs to be able to slide to maintain proper belt tension, so while belt driven system do not require adapters and couplings, their guard is larger and the design of the baseplate more complex, negating any cost savings.

Our proposals are itemized to enable the customer to consider which items they might be able to source more cost effectively on their own; they may not need a baseplate or perhaps they have a local motor distributor providing better pricing. Our itemized proposals also include common accessories such as sealless pressure regulating valves, programmable pump controllers (VFDs), pressure gauges, pipeline strainers and isolation valves.

Our company provides an application based approach to pump selection, with our decades of experience plus factory support we provide a reliable solution to the most challenging applications imaginable.

The next time you have a pump application reach out to us using one of our special web based inquiry forms, send an email or call our office; we will put our experience to work for you!

Visit us at https://innovativepumps.com/ and let us know how we can assist you with your pumping application!

Chris Pasquali has provided sales and engineering support for Wanner Engineering since 1991

#